

THE PREHISTORIC FRESHWATER MUSSELS (NAIADES) FROM BROGLEY ROCKSHELTER IN SOUTHWESTERN WISCONSIN

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ABSTRACT

This report considers nearly 6,000 freshwater mussel valves representing 25 species from the Brogley Rockshelter, a prehistoric Indian site adjacent to a small river in southwestern Wisconsin's Driftless Area. The majority of valves from Brogley are divisible into two component assemblages, one datable to circa 2800-1 B.C. and the other A.D. 1-1200. These assemblages, characterized by a complex of small river/stream taxa, are unlike modern naiad communities known in the region and add to our knowledge of prehistoric naiad zoogeography. It is suggested that poor habitat conditions resulting from early Twentieth Century land use led to the demise of most small river mussel communities in the Driftless Area.

The distribution of freshwater mussel (Mollusca: Bivalvia:Unionidae) taxa during historic times is fairly well known in those portions of the Mississippi River (e.g. Baker, 1928; Van der Schalie and Van der Schalie, 1950; Havlik and Stansbery, 1978; Thiel, 1981) and the Wisconsin River (Baker, 1928; Mathiak, 1979; Stern, 1983) that cross southwestern Wisconsin's unglaciated "Driftless Area". The smaller, interior rivers of this region; however, have received little malacological attention and are considered to be poor habitats for mussels as a result of severe historic flooding (Mathiak, 1979). The prehistoric mussel valves recovered at Brogley Rockshelter make it clear that at least some of the region's smaller rivers once contained abundant and taxonomically diverse communities of freshwater mussels.

Research on Holocene (post-glacial) stream valley deposits in the Driftless Area has documented long-term fluctuations in flood magnitudes with periods of destabilization that resulted in "large-scale erosion and reworking of valley-floor sediments, including the flushing of stored sediments from many valleys" (Knox, 1985). It is probable that pre-European Holocene mussel communities established in Driftless Area streams and small rivers would experience stress and perhaps local extirpation due to cyclical destabilization of stream beds. Although mussel populations have recently been located living in some Driftless Area small rivers, these are depauperate in species diversity when compared to similar sized streams bordering this region (Mathiak, 1979). The poor representation of modern mussel populations in the smaller rivers of the Driftless Area seems attributable

to a combination of factors, but particularly devastating would have been the extreme flooding and high sediment loads brought about by "abusive land use" practices during the early Twentieth Century (Knox, 1985). The adverse effect to most mussel taxa from severe substratum disruption, sediment in prolonged suspension or silt deposition has been widely recognized (Baker, 1928; Ellis, 1936; Van der Schalie and Van der Schalie, 1963; Parmalee, 1967; Stansbery, 1970; Fuller, 1980a; Marking and Bills, 1980; Oesch, 1984).

METHODS AND MATERIALS

The freshwater mussel valves recovered at Brogley Rockshelter are housed at the University of Wisconsin-Madison, Department of Anthropology, where they were studied. The species represented, total number of valves, minimum number of individuals (MNI), and the relative abundance (%) of each species is presented in Table 1. The MNI was determined by the maximum number of right or left valves of each naiad species present in the Brogley Rockshelter components (see Table 2).

The naiad taxonomy used in this report follows the nomenclature presented by Stansbery (1982) and employed by Oesch (1984). (Oesch's work offers selected commentary from Stansbery on taxa having controversial nomenclature.) A series of voucher specimens for each species represented in the Brogley Rockshelter, Preston Rockshelter, Millville site and modern Grant River assemblages are on deposit at the Ohio State University, Museum of Zoology (OSUM). The use

Table 1. Freshwater mussels identified at Brogley Rockshelter by component.

Family Unionidae	Woodland Component A.D. 1-1200			Archaic Component 2800-1 B.C.			Unproveni- enced			Site Total		
	Valves	Indiv.	%	Valves	Indiv.	%	Valves	Indiv.	%	Valves	Indiv.	%
Subfamily Anodontinae												
<i>Anodonta grandis</i> s.l.	6	5	.50	14	8	.76	8	4	.39	28	17	.55
<i>Anodontoides ferussacianus</i> (Lea)	0	0	0	5	3	.29	1	1	.10	6	4	.13
<i>Strophitus undulatus undulatus</i> (Say)	61	33	3.29	66	35	3.33	34	20	1.94	161	88	2.85
<i>Alasmidonta marginata</i> Say	36	23	2.29	23	14	1.33	39	21	2.04	98	58	1.88
<i>A. viridis</i> (Rafinesque)	12	6	.60	2	2	.19	14	9	.87	28	17	.55
<i>Arcidens confragosus</i> (Say)	0	0	0	0	0	0	1	1	.10	1	1	.03
<i>Lasmigona complanata</i> (Barnes)	0	0	0	1	1	.10	0	0	0	1	1	.03
<i>L. costata</i> (Rafinesque)	20	10	1.00	22	16	1.52	16	9	.87	58	35	1.13
<i>L. compressa</i> (Lea)	8	5	.50	10	6	.57	8	5	.49	26	16	.52
Subfamily Ambleminae												
<i>Megalonaia nervosa</i> (Rafinesque)	1	1	.10	1	1	.10	0	0	0	2	2	.06
<i>Quadrula pustulosa</i> (Lea)	0	0	0	0	0	0	1	1	.10	1	1	.03
<i>Amblema plicata</i> (Say)	2	2	.20	3	3	.29	2	1	.10	7	6	.19
<i>Fusconaia ebena</i> (Lea)	1	1	.10	0	0	0	1	1	.10	2	2	.06
<i>F. flava</i> (Rafinesque)	46	31	3.09	60	38	3.62	35	18	1.75	141	87	2.82
<i>Elliptio crassidens crassidens</i> (Lamarck)	0	0	0	0	0	0	1	1	.10	1	1	.03
<i>E. dilatata</i> (Rafinesque)	1246	643	64.04	1274	656	62.42	1372	712	69.13	3892	2011	65.19
Subfamily Lampsilinae												
<i>Actinonaias ligamentina carinata</i> (Barnes)	5	5	.50	3	2	.19	6	4	.39	14	11	.36
<i>Potamilus alatus</i> (Say)	2	1	.10	3	3	.29	5	3	.29	10	7	.23
<i>Ligumia recta</i> (Lamarck)	1	1	.10	0	0	0	0	0	0	1	1	.03
<i>Venustaconcha ellipsiformis ellipsiformis</i> (Conrad)	441	221	22.01	319	182	17.31	383	192	18.64	1143	595	19.30
<i>Villosa iris iris</i> (Lea)	0	0	0	1	1	.10	2	2	.19	3	3	.10
<i>Lampsilis teres teres</i> (Rafinesque)	0	0	0	0	0	0	2	2	.19	2	2	.06
<i>L. teres anodontoides</i> (Lea)	0	0	0	0	0	0	1	1	.10	1	1	.03
<i>L. radiata luteola</i> (Lamarck)	16	11	1.10	115	66	6.28	25	16	1.55	156	93	3.01
<i>L. ventricosa</i> (Barnes)	5	5	.50	25	14	1.33	11	6	.58	41	25	.81
Subtotals	1909	1004	100.02	1947	1051	100.02	1968	1030	100.01	5824	3085	99.98
Unidentifiable	17			24			9			50		
Totals	1926	1004	100.02	1971	1051	100.02	1977	1030	100.01	5874	3085	99.98

of certain subspecific designations for subfossil material in this report is in keeping with the catalogued voucher series at OSUM and serves to distinguish closely related taxa that differ in shell morphology and currently understood distribution, but are at present defined as distinct only at the subspecific level. The subspecific determination of *Anodonta grandis corpulenta* Cooper, 1834 for the modern Grant River material is based on identifications made at the OSUM. The subfossil *Anodonta grandis* from the Brogley and Preston Rockshelters deposited as vouchers at OSUM were assigned to *A. g. grandis* Say, 1829; however, valves are listed in this report as *A. grandis* (*sensu lato*) as the author lacked certainty in some subspecific identification.

SITE LOCATION AND DESCRIPTION

The Brogley Rockshelter is a prehistoric Indian site (state code number 47Gt156) located under a sandstone cliff adjacent to the Platte River in section 8, T3N, R2W, Grant

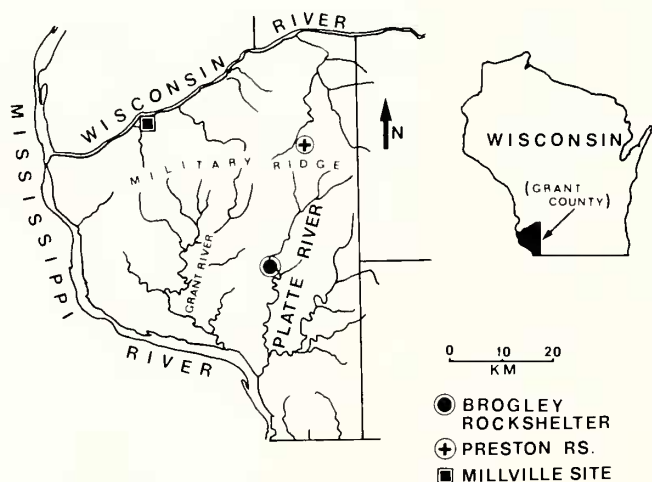


Fig. 1. Map showing location of Brogley Rockshelter, Preston Rockshelter and the Millville site.

County, Wisconsin (Fig. 1). This site was found to contain prehistoric Indian occupation refuse and sediment extending to a depth of 2.6 m below the surface when excavated by Mr. Robert H. Nelson between 1967 and 1971. Based on the recovered archaeological materials and radiocarbon dating, Brogley Rockshelter is divisible into two major periods of intermittent human occupation. The upper 1.5 m of the shelter deposit contained artifactual remains that indicate a Woodland cultural tradition occupation between A.D. 1 and A.D. 1200. The lower 1.1 m of the site deposit is an Archaic cultural component with artifacts and a series of radiocarbon determinations indicating most human occupation occurred between 2800 and 1 B.C. The radiocarbon dating and archaeological content of Brogley have been discussed by Bender *et al.* (1971), (1973), Emerson (1979), Geier and Loftus (1975) and Tiffany (1974).

PHYSICAL SETTING

The rough hill country of southwestern Wisconsin com-

prises much of the 35,000 km² Driftless Area (Martin, 1965; Roosa, 1984) with small portions extending into three adjacent states. This region lacks evidence for Pleistocene glaciation and is characterized by steep-sided, stony valleys dissecting the uplands with dendritic patterns of small stream development. The upland ridges and escarpments of the larger valleys exhibit 50 to 150 m of relief. The two prominent rivers crossing the region are the Mississippi, forming the western border of Wisconsin, and the Wisconsin River which drains a large area of central and southwestern Wisconsin. Both rivers were major meltwater channels during the terminal phases of the Pleistocene.

The southernmost county in Wisconsin, Grant, is bisected by an east-west trending drainage divide, the Military Ridge. To the north of this divide, streams drain into the Wisconsin River, and to the south into the Mississippi. One small river draining south is the Platte. In the vicinity of Brogley Rockshelter, the Platte River is 5 to 15 m in width with a series of riffles connecting pools. The drainage area of the Platte River above Brogley is approximately 365 km²

Table 2. Freshwater mussel distribution by depth at Brogley Rockshelter.

Cultural Component: Approximate Date: Feet Below Surface: Valve Side:	Woodland A.D. 1-1200				Archaic 2800-1 B.C.			
	0-0.4	0.4-1.4	1.4-2.4	2.4-3.4	3.4-4.4	4.4-5.4	5.4-6.4	6.4-7.4
	L/R	L/R	L/R	L/R	L/R	L/R	L/R	L/R
Family Unionidae								
Subfamily Anodontinae								
<i>Anodonta grandis</i> s.l.	—	0/1	3/0	2/0	3/0	3/8	—	—
<i>Anodontooides ferussacianus</i>	—	—	—	—	1/0	2/2	—	—
<i>Strophitus undulatus undulatus</i>	1/3	4/1	11/20	12/9	10/14	22/15	3/2	—
<i>Alasmidonta marginata</i>	4/2	7/2	8/6	4/3	2/5	10/4	2/0	—
<i>A. viridis</i>	—	0/2	5/4	1/0	—	2/0	—	—
<i>Arcidens confragosus</i>	—	—	—	—	—	—	—	—
<i>Lasmigona complanata</i>	—	—	—	—	—	—	1/0	—
<i>L. costata</i>	2/2	2/0	5/6	1/2	4/2	11/3	1/1	—
<i>L. compressa</i>	—	1/1	2/2	0/2	2/2	2/3	0/1	—
Subfamily Ambleminae								
<i>Megaloniaias nervosa</i>	—	—	—	0/1	—	—	1/0	—
<i>Quadrula pustulosa</i>	—	—	—	—	—	—	—	—
<i>Amblema plicata</i>	1/0	—	1/0	—	1/0	2/0	—	—
<i>Fusconaia ebena</i>	—	—	0/1	—	—	—	—	—
<i>F. flava</i>	3/1	8/0	17/9	3/5	9/12	27/10	2/0	—
<i>Elliptio crassidens crassidens</i>	—	—	—	—	—	—	—	—
<i>E. dilatata</i>	45/45	194/194	270/271	134/93	158/142	407/392	87/79	4/5
Subfamily Lampsiliinae								
<i>Actinonaias ligamentina carinata</i>	—	—	0/3	0/2	0/1	1/0	—	1/0
<i>Potamilus alatus</i>	1/0	0/1	—	—	—	3/0	—	—
<i>Ligumia recta</i>	—	—	—	1/0	—	—	—	—
<i>Venustaconcha ellipsiformis ellipsiformis</i>	18/22	51/57	137/107	45/34	69/55	99/72	11/8	3/2
<i>Villosa iris iris</i>	—	—	—	—	1/0	—	—	—
<i>Lampsilis teres teres</i>	—	—	—	—	—	—	—	—
<i>L. teres anodontooides</i>	—	—	—	—	—	—	—	—
<i>L. radiata luteola</i>	—	2/0	1/1	8/4	16/9	45/36	4/3	1/1
<i>L. ventricosa</i>	—	1/0	1/0	1/2	5/2	2/11	3/1	1/0
Subtotals	150	529	861	369	525	1194	210	18
Unidentifiable Valves	2/0	1/2	0/2	7/3	5/3	8/2	5/1	0/0

(Holstrom, 1972) and this river enters the Mississippi River 16 km to the south of the site.

RESULTS

THE BROGLEY ROCKSHELTER MUSSEL ASSEMBLAGE

A total of 5874 freshwater mussel valves, representing at least 3085 individuals and 25 species were recovered through archaeological excavations at Brogley Rockshelter. The valves are grouped into the previously mentioned Woodland and Archaic cultural components identified for the site (Table 1) and by specific levels (Table 2). Approximately one-third of the total site assemblage came from unprovenienced contexts.

The most abundant mussel species recovered at Brogley was the spike, *Elliptio dilatata* (Rafinesque), representing 65.2% (=2011 individuals) of the site total. With few exceptions, valves of *E. dilatata* from Brogley are the stream or small river ecoform [= *E. dilatatus delicatus* (Simpson) (see Baker, 1928)]. A small number of large, robust *E. dilatata* valves (n = 2 right, 4 left) seem to represent the large river phenotype characteristic of the Mississippi and lower Wisconsin rivers. In streams and small rivers *E. dilatata* can be found in moderate current on a sand and/or gravel substratum in 0.3 to 0.6 m of water (Baker, 1928). In eastern Wisconsin the author has found the small river ecoform of this taxon most densely concentrated on mixed silt, sand and gravel in quieter water at the margin of riffles and runs.

The ellipse mussel, *Venustaconcha ellipsiformis ellipsiformis* (Conrad), was second in abundance at Brogley with 595 individuals comprising 19.3% of the total assemblage. The ellipse is characteristic of streams and small rivers in eastern Wisconsin (Mathiak, 1979) and elsewhere in the Midwest (e.g. Van der Schalie and Van der Schalie, 1963; Parmalee, 1967; Oesch, 1984) where it is found on a substratum of sand and gravel in riffles and runs under a moderate to swift current (Baker, 1928; Van der Schalie and Van der Schalie, 1963). In the main stem Mississippi River the ellipse is a very rare extralimital species (Van der Schalie and Van der Schalie, 1950; Fuller, 1980a).

Elliptio dilatata and *Venustaconcha ellipsiformis ellipsiformis* together total 84.5% of the Brogley Rockshelter naiad assemblage with only five of the remaining 23 taxa contributing more than 1.0% each. These five are *Lampsilis radiata luteola* (Lamarck) with 93 individuals representing 3.0% of the assemblage; *Strophitus undulatus undulatus* (Say) with 2.9%; *Fusconaia flava* (Rafinesque) with 2.8%; *Alasmidonta marginata* Say, with 1.9% and *Lasmigona costata* (Rafinesque) with 35 individuals equalling 1.1% of the assemblage. The *F. flava* specimens are compressed headwater or small river ecoforms (see Ortmann, 1920). *S. u. undulatus*, *A. marginata* and *L. costata* are most abundant in small rivers and streams. Although *L. r. luteola* occurs in a wide range of aquatic habitats, the Brogley specimens represent a small river phenotype. Additional species at Brogley Rockshelter characteristic of small rivers and streams include *Alasmidonta viridis* (Rafinesque) with 17 individuals

comprising 0.6% of the assemblage, *Lasmigona compressa* (Lea) with 0.5%, *Anodontooides ferussacianus* (Lea) with 0.1% and *Villosa iris iris* (Lea) with 3 individuals representing 0.1% of the Brogley naiades.

The remaining 14 naiad species at the site, each contributing less than 1.0% of the assemblage, are divided into two groups based on habitat association. The first group includes *Anodonta grandis*, *Lasmigona complanata* (Barnes), *Quadrula pustulosa* (Lea), *Amblema plicata* (Say), *Actinonaias ligamentina carinata* (Barnes), *Potamilus alatus* (Say), *Ligumia recta* (Lamarck), *Lampsilis teres teres* (Rafinesque), and *L. ventricosa* (Barnes). Taken together these nine species are represented by 71 individuals and comprise 2.3% of the assemblage. They can be found in a range of stream sizes from large to rather small rivers. It seems feasible that they were uncommon members of the prehistoric Platte River naiad community, although it is possible that some of these valves were brought to Brogley from sources other than the Platte River as raw material for tools or as curios. One of two *L. t. teres* valves has a humanly modified ventral margin indicating its use as a tool.

The second group of five species, each represented by one or two individuals at Brogley includes *Arcidens confragosus* (Say), *Megaloniais nervosa* (Rafinesque), *Fusconaia ebena* (Lea), *Elliptio crassidens crassidens* (Lamarck), and *Lampsilis teres anodontooides* (Lea). In southwestern Wisconsin these taxa seem associated with the large river habitats such as the Mississippi River or the lower Wisconsin River. Together, this group has seven individuals comprising 0.2% of the site assemblage. Many of the prehistoric peoples of southwestern Wisconsin were hunters and gatherers who moved on a seasonal round that included summer season harvest of freshwater mussels, fish and various other game along the Mississippi River. In the fall of the year these people often moved inland to winter hunting camps (Theler, 1983), such as Brogley Rockshelter. *E. c. crassidens* could have been brought to Brogley from the Mississippi River, its only known historic habitat in Wisconsin (Baker, 1928). The striking salmon colored nacre and large shell size could have contributed to the desirability of *E. c. crassidens* among prehistoric peoples. A valve of this taxon was found in association with a Woodland tradition human infant burial in the interior of the Driftless Area (Mead, 1979).

A possible source for valves of *Fusconaia ebena*, *Arcidens confragosus*, and *Lampsilis teres anodontooides* may be the Wisconsin or Mississippi rivers (Baker, 1928; Stern, 1983) but they would be unexpected or very rare in the Platte River. The *L. t. anodontooides* valve has a humanly modified ventral margin indicating its use as a tool. The river of origin for the two valves of *Megaloniais nervosa* is uncertain. This species exists in some numbers in the modern-day upper Mississippi River (Thiel, 1981; Duncan and Thiel, 1983), but was not present among the large assemblages of analyzed mussel valves from prehistoric Indian shell middens along the upper Mississippi River in southwestern Wisconsin (Theler, 1983). *M. nervosa* has been recovered as a rare species at prehistoric Indian sites along the Mississippi River in the Rock Island area of Illinois (Van Dyke et al., 1980) and

at La Crosse, Wisconsin (Stevenson, 1985). A single valve of *M. nervosa* was present at the prehistoric Millville archaeological site on the lower Wisconsin River (Theler, 1983) in Grant County, Wisconsin, but has not been recorded from that river in historic times (Baker, 1928; Mathiak, 1979; Stern, 1983). One of the two Brogley specimens is a large, heavy valve with a battered ventral margin indicating its use as a tool. Unfortunately, the more obvious artifacts fashioned from mussel shells presumably found at Brogley were not located during this study.

INTRASITE VARIABILITY

When compared to the Woodland component, the earlier Archaic occupation levels at Brogley Rockshelter contain a greater relative abundance of *Lampsilis radiata luteola*, *L. ventricosa*, *Anodonta grandis*, *Lasmigona costata* and the only provenienced *Anodontooides ferussacianus*. These taxa are generally associated with a low energy aquatic environment and a fine sediment substratum. The Woodland component contains a higher frequency of *Elliptio dilatata*, *Venustaconcha ellipsiformis ellipsiformis*, *Alasmidonta marginata*, and *A. viridis*. These last named species are most frequently associated with a moderate to strong current velocity over a substratum of sand and gravel. The component distribution may indicate greater availability or exploitation of low energy habitats with silt and/or sand substratum during the Archaic occupation at Brogley Rockshelter.

THE PRESENT-DAY PLATTE AND GRANT RIVERS

Today the Platte River is a stream with silt laden pools and it often carries a high load of suspended sediments. Nonetheless, it supports a substantial fish population (Fago, 1985) and contains many riffles and runs having a gravel/cobble substratum. Careful examination of several seemingly adequate habitats in the vicinity of Brogley in 1982 and 1985 failed to locate any living naiades or fresh shells. A few eroded valves of *Elliptio dilatata* were found mixed with the gravel/cobble substratum. It is possible that small, undiscovered naiad populations now exist in some portions of the Platte River.

Located immediately to the west of the Platte is the Grant River (Fig. 1), a stream similar to drainage configuration and size to the Platte. The Grant River contains a few small naiad populations; one location above the village of Burton contains living *Anodonta grandis corpulenta*, *Strophitus undulatus undulatus*, *Tritogonia verrucosa* (Rafinesque), *Quadrula quadrula* (Rafinesque), *Lasmigona complanata*, *L. costata* and *Lampsilis ventricosa*. Mussel valves from this locale that have been dead for an undetermined length of time included *Alasmidonta marginata*, *Fusconaia flava*, *Lepetodea fragilis* (Rafinesque), *Potamilus alatus*, *Ligumia recta*, and *Lampsilis radiata luteola*. In a headwater branch of the Grant, the Little Grant River, living *Lasmigona costata* and *Lampsilis ventricosa* were found by the author in 1985. A single living *Venustaconcha ellipsiformis ellipsiformis* was also found in the Grant below Burton by David J. Heath in 1983.

INTERSITE COMPARISONS

At present, the prehistoric assemblage of freshwater mussel valves recovered at Brogley Rockshelter stands alone in its large sample size and species diversity for the smaller rivers and streams of the Driftless Area. An additional Driftless Area archaeological site in a small stream setting that has produced a series of mussel valves is Preston Rockshelter (47Gt157). This site is located on the north side of the Military Ridge adjacent to a tributary of Fennimore Creek, a branch of the Blue River that in turn empties into the Wisconsin River 19 km from the site in Grant County (Fig. 1). Excavations at Preston uncovered evidence for intermittent human occupation between 1000 B.C. and A.D. 1200. Although a large amount of humanly introduced animal bone (as food refuse) was recovered from the site, only 75 unmodified freshwater mussel valves of eight taxa were present (Theler, 1983).

The most abundant taxon in the Preston Rockshelter mussel assemblage was *Anodonta grandis* represented by 30 valves that comprise 40.0% of all shells recovered. Next in order of abundance were *Lampsilis radiata luteola* (14 valves, 18.7%), *Lampsilis ventricosa* (12 valves, 16.0%) and *Anodontooides ferussacianus* (10 valves, 13.3%). The remaining mussel species at Preston were *Potamilus alatus* (4 valves), *Elliptio dilatata* (3 valves), *Amblema plicata* (1 valve) and *Lasmigonia complanata* (1 valve), together totaling 11.9% of the assemblage.

The four most frequently occurring mussel species at Preston Rockshelter were taxa usually found living in low energy aquatic regimes. The abundance of riparian mammal bones (e.g. muskrat and beaver) and some waterfowl remains among the Preston bone refuse could indicate that headwater portions of Fennimore Creek were periodically impounded, perhaps by beaver dams, during the prehistoric occupation, thus enhancing the local habitat for certain mussel taxa such as *Anodonta* and *Anodontooides*. The four least common species at Preston Rockshelter may have been present in the Blue River or perhaps Fennimore Creek at some time in the past, although both streams appear devoid of living mussels today. The valves of *Elliptio dilatata* from Preston are the small stream ecoform.

The mussel assemblage from Preston Rockshelter is in sharp contrast to that found at Brogley where *Elliptio dilatata* and *Venustaconcha ellipsiformis ellipsiformis* together comprised the majority of recovered mussel valves and is interpreted as reflecting availability of suitable habitat for these species. The absence at Preston of *V. e. ellipsiformis*, *Alasmidonta viridis*, *Villosa iris iris* and the rarity of *E. dilatata* seems to indicate that the preferred habitat of these taxa, a small to medium sized stream having a stable gravel/sand substratum with a good current may not have been present in the vicinity of the site during its utilization.

Assemblages of freshwater mussel valves found at aboriginal sites adjacent to large rivers crossing the Driftless Area are distinct from those of small rivers in their species composition and phenotypic variation in shell morphology for certain taxa. On the lower Wisconsin River in Grant County (Fig. 1), the Millville site (47Gt153) was occupied by Woodland tradition peoples at about A.D. 400. Excavation at Millville

in 1962 produced 174 mussel valves, with 20 species represented (Theler, 1983). The seven most abundant taxa were, *Fusconaia flava* with 25 valves representing 14.4% of the assemblage, *F. ebena* (20 valves, 11.5%), *Actinonaias ligamentina carinata* (19 valves, 10.9%), *Amblema plicata* (18 valves, 10.3%), *Elliptio dilatata* (15 valves, 8.6%), *Quadrula metanevra* (Rafinesque) (13 valves, 7.5%) and *Plethobasus cyphus* (Rafinesque) (10 valves, 5.7%). In southwestern Wisconsin, *F. ebena*, *Q. metanevra* and *P. cyphus* are reported in the historic period only from the Wisconsin and Mississippi rivers (Baker, 1928; Mathiak, 1979; Stern, 1983).

A number of prehistoric mussel assemblages have been recovered at aboriginal sites along the main stem Mississippi River near the confluence of the Wisconsin and Mississippi rivers (Theler, 1983). In summarizing more than 29,000 mussel valves of 28 species recovered from seven Woodland tradition sites dating between A.D. 70 and A.D. 1200, *Fusconaia ebena* ranked first comprising 58.2% of the total, followed by *Quadrula metanevra* (7.7%), *Amblema plicata* (6.9%) and *Pleurobema sintoxia* (Rafinesque) (5.9%). *Elliptio dilatata* ranked ninth (1.5%) in relative abundance (Theler, 1987).

The assemblages from the Millville site and those along the main stem Mississippi River lacked many species typical of smaller rivers including *Anodontoides ferussacianus*, *Alasmidonta viridis*, *Lasmigona compressa*, *Venustaconcha ellipsiformis ellipsiformis* and *Villosa iris*.

Although no metric data have been collected, valves of *Fusconaia flava* from Millville and the seven Mississippi River sites are more inflated than the valves from Brogley Rockshelter, consistent with the magnitude of their apparent rivers of origin (see comments by Ortmann 1920:282-284, 310-312). The *Elliptio dilatata* are distinctly larger and heavier at sites located adjacent to the Wisconsin and Mississippi rivers when compared to the majority of specimens from Brogley and Preston Rockshelters, like *F. flava*, *E. dilatata* appear to exhibit strong phenotypic trends in shell morphology.

DISCUSSION

The prehistoric peoples who occupied Brogley Rockshelter could have introduced a few mussel valves into the site from sources other than the Platte River, possibly the main stem Mississippi River. The great majority of the Brogley valves appear to represent the remains of mussels gathered from the Platte River as a food source.

Taken together, most of the species at Brogley Rockshelter are typical of a small river naiad community with an assemblage composition similar to that found in modern-day streams of good water quality in eastern Wisconsin (Baker, 1928; Mathiak, 1979), but not in small rivers of Wisconsin's Driftless Area. The small river naiad community identified at Brogley became established in the Platte River some time before 4800 years ago. The most feasible route for arrival of naiad populations is through glochidia dropped from host fish that entered the Platte River drainage by way of the Mississippi River. The establishment of species ex-

tralimital to the main stem Mississippi (e.g. *Venustaconcha ellipsiformis ellipsiformis* and *Alasmidonta viridis*) would presumably be a rare event. Once established in Driftless Area small rivers, naiades could have experienced periodic population declines during episodes of severe flood erosion or siltation, with recovery during periods of low flood intensity. While the historic period is marked by the most intense Holocene erosion and sediment deposition (Knox, 1977; 1985), a few naiades survive as circumscribed populations in some Driftless Area streams. The single living *V. e. ellipsiformis* found in the Grant River is possibly a representative of a relict population surviving the regional habitat stress during the Twentieth Century.

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